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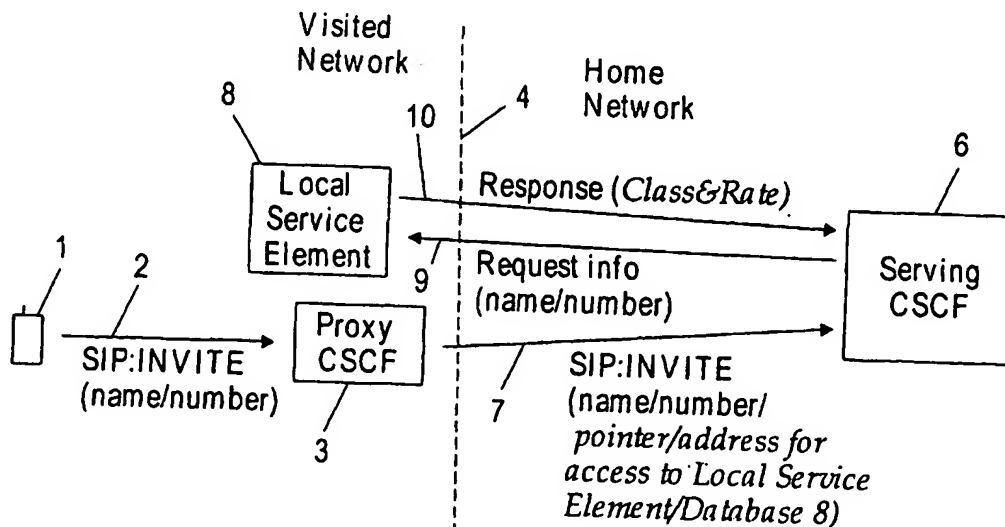
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(54) Title: **ROAMING SUPPORT METHOD AND SYSTEMS IN UMTS**



(57) Abstract: The invention relates to a communication method and system wherein a network element of a roaming user is attachable to a visited first network and may still be served by a serving means of the home network. When the network element of the roaming user is registering or initiating a connection to a called network element of the visited network, a network element of the visited network such as proxy means either adds information on the called network element or on a service element of the visited network when sending a message to the home network. The message is preferably sent as a protocol message, in particular a message of the Session Initiation Protocol (SIP).

WO 02/13567 A1

ROAMING SUPPORT METHOD AND SYSTEMS IN UMTS

FIELD OF THE INVENTION

10 The invention relates to the field of mobile communication.
In particular, the invention addresses the handling of
connections or connection-related parameters in a case
where a connection involves two or more networks.

15

BACKGROUND OF THE INVENTION

In recent or planned network architectures, different
service models for roaming subscribers may be provided.

20 When a user is roaming, the control means or control
function (such as the Serving-CSCF "Call State Control
Function" in a network architecture according to Release
2000) to which a subscriber is registered and where the
connection control such as the call state control is

25 handled, may still be located in the home network. In such
a home service model, it is important to pass different
kinds of information from the visited network to the home
network for proper connection control.

30 When, for instance, the serving control function does not
have all necessary information, e.g. on service class or
charging rate, etc., the control function may improperly
handle or charge a connection such as a call from a roaming
subscriber to another equipment or user.

35

SUMMARY OF THE INVENTION

The invention provides a system and a method which enable
5 an appropriate handling or processing of a connection such
as a call even when a subscriber should be attached to a
visited network.

In accordance with an aspect of the invention, a
10 communication system is provided as defined in the claims.

According to a further aspect of the invention, a method is
provided as defined in the method claims.

15 In more detail, the invention is directed to a
communication method and/or communication system comprising
at least one first network element attachable to a visited
first network and connectable to a second network element
of the visited first network, the second network element
20 being able to access a third network element located in a
second network. The first network element is adapted to
send a first message to the second network element for
registering to the first network or getting connected to
the third network element or a fourth network element of
25 the visited first network. The second network element is
adapted to send a second message to the third network
element, the second message containing additional
information either related to the handling or processing of
a connection from the first network element to the fourth
30 network element, or related to an address of, or identifier
identifying, a further network element of the first network
which contains, or has access to, a database comprising
information related to the handling or processing of a
connection to the fourth network element. The third network
35 element is adapted to use this additional information for

handling the connection or processing one or more connection-related function, or for accessing the further network element, or for storing the additional information and for providing it upon request. The message is
5 preferably transmitted as a protocol message, in particular of the Session Initiation Protocol (SIP).

The invention generally provides for the transfer of service information and/or other information from a visited
10 network to a home network, preferably in a case of home service model where the call control such as call state control is handled in the home network. In accordance with a preferred aspect of the invention, the visited network provides a proxy function such as a proxy call state
15 control function (CSCF), which is able to pass information to the home network, preferably to a serving control means or function such as serving CSCF, or to a subscriber serving function or means such as HSS (Home Subscriber Server).

20 In accordance with a preferred aspect of the invention, problems related to properly handling or processing connections of a roaming subscriber are solved. As an example, the invention allows an appropriate charging or
25 other call control when a roaming subscriber calls to a destination in the visited network, e.g. to a local PSTN (Public Switched Telephone Network). As the home network normally does not know detail level information on local numbers and/or logical names and/or aliases used in the
30 visited network, the control means or function such as the proxy function (e.g. proxy CSCF) in the visited network is, in accordance with one embodiment of the invention, adapted to add information about the called local destination. As
35 an example, the added information can indicate the charging rate and type of destination. The proxy server or function

can add this information e.g. on a call-basis when the visiting subscriber calls to a local destination of the visited network via the proxy server.

- 5 In accordance with another embodiment of the invention, the proxy server or function can add a pointer pointing to a local service or service element of the visited network from which the serving control function of the home network can ask information on the destination (e.g. charging rate,
10 type of destination, etc.).

Instead of adding such a pointer on a call-basis, i.e. adding it to each call notification, a pointer pointing to a local service element having relevant information on the
15 destinations in the visited network may also be passed at the registration phase.

The structure and method according to the invention also offer the possibility of performing other services such as
20 call barring in the home network based on the information received from the visited network. When e.g. the call control function or means of the home network has received call barring information input e.g. by a user or company and defining, for instance, the barring of outgoing
25 international calls, the call control function or means of the home network will request the visited network control function or means (e.g. proxy server of the visited network) not to establish a connection when the roaming subscriber requests the call control function or means of
30 the visited network to initiate a connection to an international call (the call control function or means of the visited network reports on such a request to the serving control function of the home network before establishing such a call).

35

Preferably, signalling information (messages) transmitted is secured and authenticated between different networks.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a first embodiment of the invention which provides service information transfer from a visited network to a home network;

10

Figure 2 shows a further embodiment of the invention in which the transfer of service information from the visited to the home network is performed on a call-basis by transmitting a pointer; and

15

Figure 3 shows another embodiment of the invention providing a transfer of service information from the visited to the home network in which a pointer is passed at the registration phase.

20

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

25 Figure 1 shows an embodiment of the invention in a condition where a mobile network element 1 such as a mobile terminal, e.g. mobile phone, has roamed to another network ("visited network") from its home network in which it is registered as a subscriber. The visited network comprises a
30 further network element 3 which is, in this embodiment, a control means or function such as a proxy CSCF (Call State Control Function). This function or the means 3 performing this function, as well as the other network elements are described in e.g. 3GPP's TR 23.821 v1.0.0. (accessible for
35 instance via Internet www.3gpp.org). The borderline between

the visited network and the home network is represented by a broken line 4. The home network comprises a serving CSCF 6 to which the subscriber of network element 1 is registered and where the call state control including e.g. charging is handled.

When the mobile network element 1 requests to be connected to another network element registered to the visited network, the network element 1 sends a message 2 to the proxy element 3 identifying the other network element e.g. by name or number or other identifier. This message preferably is a protocol message. In a preferred embodiment, the protocol message is a SIP (Session Initiation Protocol) word indicating name and/or number of the called party. The protocol word may be a SIP:INVITE message.

The proxy means 3 comprises, or has access to, a table which comprises additional information such as service class, e.g. payphone, charging information, e.g. charging rate, etc., mapped to the subscriber identification (e.g. name or number) of the subscribers of the visited network. In addition, the proxy means 3 contains or may have access to network or network element related information such as e.g. time zone, service capabilities of visited network or network elements and service interworking information for visited network and home network co-operation. When receiving message 2, the proxy means 3 looks up the additional information or parameters stored for the called party by using the identification (name or number) included in message 2, and sends a message 5 to the serving function or means 6 of the home network. In addition, information related to visited network or network elements may additionally or alternatively be included in message 5.

The message 5 may be a protocol word, preferably SIP:INVITE, which now includes, in addition to the name and/or number or other identifier identifying the party to which a connection is to be established, additional parameters or information necessary for appropriately handling or processing the connection from network element 1 to the called party. The name and/or number or other identifier included in message 5 may be the same information as the information contained in message 2, or may be derived therefrom or from other information. As an example, when e.g. a call repetition request is sent in message 2, this call repetition request may for example be translated into the name or other identifier of the party to which a connection is to be established, e.g. using a database which stores the last called numbers or the like.

In the present example, the additional information included in message 5 is "service class: payphone" and "charging info: rate". The serving means 6 therefore has sufficient information for properly controlling, handling or processing the call, including correctly charging the costs for the connection.

This structure ensures proper functioning of the network and alleviates control means 6 from the burden of fixedly storing information on all network elements of all other networks to which roaming of the own subscribers is allowed. Each network to be visited may have one or more of the proxy means 3 being able to add additional information to message 5 identifying or characterizing the party or equipment to which network element 1 wants to get connected or additional information related to the visited network or network elements in it.

35

The structure of the communication system shown in Figure 1 thus enables the transfer of service information from the visited to the home network on a per-call-basis wherein the relevant parameters for the called party or the visited
b network are directly included in the message 5 sent from network element 3.

Figure 2 shows a further embodiment of the invention in which the proxy means 3 stores a pointer pointing to a
10 local service element 8 of the visited network. The local service element 8 is or comprises a database in which information and/or parameters for the subscribers of the visited networks are stored. This information or parameters preferably includes information such as service class (e.g.
15 payphone, and charging rate, e.g. business tariff or private tariff. In addition, information related to the visited network or network elements may be stored in the database of service element 8. This information includes e.g. time zone, service capabilities of visited network or
20 network elements and service interworking information for visited network and home network co-operation. Such a structure alleviates the proxy means 3 from storing or accessing an own database and thus reduces the storage and processing capacity requirements of the proxy means 3.

25 In the case of Figure 2, when the network element 1 such as a mobile user phone wants to get connected to another network element registered to the visited network such as a subscriber or host or the like, it sends as first step,
30 similar to the case of Figure 1, a message 2 to the proxy means 3 which includes an identifier for identifying the called network element or party (name and/or number of the called entity). When receiving message 2, the proxy means 3 responds by sending a message 7 to the serving entity 6 of
35 the home network of network element 1. Similar to the

message 2, the message 7 is a protocol message preferably of the SIP protocol, such as a SIP:INVITE message. However, the proxy means 3 has included into message 7, in addition to the name/number of the called party, an identifier such as a pointer pointing to another network element of the visited network, preferably the local service element 8.

The proxy means 3 may alternatively or additionally add some other information that is associated to local service element 8 and the called number or the visited network or network elements. This parameter may be a 'key' that is used when Local Service Element is queried by means 6. This 'key' is used e.g. for security purposes. This 'key' is pointing to the actual information for the called number, the visited network and/or the visited network elements.

The pointer may be any information identifying the local service element 8 such as an address sufficient for addressing element 8. The local service element 8 contains a database in which the subscriber names or numbers of the subscribers of the visited network are mapped to the information or parameters necessary for properly handling or processing connections to the subscribers of the visited network. The local service element 8 may also store visited network specific or network element specific information accessed from the database using the 'key' mentioned above. After having received message 7, the serving means 6 sends a message 9 to the local service element 8 identified by the pointer contained in message 7. The message 9 is a request to the local service element 8 requesting the element 8 to send information on the party to be called or information related to the visited network or network elements. Message 9 may be a query used to determine charging. Message 9 includes the name and/or number of the party to be called for identifying it, and eventually also

the above mentioned key. Local service element 8 looks up its database and responds to message 9 by returning message 10, in which information on the called party relevant for properly handling a connection to the called party is included, such as service class and charging rate. Message 10 may also include direct instructions for connection processing. The serving means 6 now has sufficient information for properly treating and processing, including charging, of the connection between network element 1 and the called entity.

In the case of Figure 2, the transfer of service information from the visited network to the home network is performed in several steps, by first sending message 7 from the visited network to the home network, then returning message 9 from the home network to the visited network and accessing the database of local service element 8, and finally sending the call-related information from the visited network to the home network by message 10. Hence, the service information transfer from a visited to a home network is performed by passing a pointer on a per-call-basis, i.e. by each call involving a connection between a roaming subscriber of the home network and a subscriber of the visited network.

Figure 3 shows a further embodiment in which, for service information transfer from a visited network to the home network, a pointer pointing to a local service element of a visited network is passed at the registration phase.

When a subscriber to the home network has roamed to the visited network and wants to use or activate his/her terminal network element 1 such as a mobile phone or laptop, e.g. by switching element 1 on, the network element generates a "register" request which is sent to the proxy

server or function 3 of the visited network. This register request may be a message 11, SIP:REGISTER... The details of SIP are defined e.g. in RFC2543, which document inter alia explains the "INVITE" and "REGISTER" requests and the handling thereof. The disclosure contents of this document is included herein.

When the proxy means 3 receives the REGISTER request 11, it responds by sending a message 12 to the home network. The message 12 may likewise be a request "SIP:REGISTER". In message 12, in addition to the information identifying network element 1 to be registered, a pointer is added which points to a local service element or a database of the visited network such as element 8 of Figure 2. This local service element or database contains information on the network entities or users subscribed to the visited network, the information including service class and charging information for properly building connections to the subscribers of the visited network, as already explained above with regard to Figures 1 and 2. The message 12 is addressed to a register of the home network registering such information for access to the local service element/database of the visited network. The pointer contained in message 12 may be the access address of the local service element or database such as element 8, or any other appropriate identifier. According to Figure 3, the message 12 is directed to a network element of the home network of network element 1.

The element 13, to which message 12 is directed and in which the pointer or address for the local service element/database is stored may be the home subscriber server (HSS) 13 of the home network, or any other register storing location information related to the subscribers including roaming subscribers to the home network. This

register such as the home subscriber server 13 stores, in its database, the basic subscriber data for the network element 1 registering to the visited network, and in relation thereto the pointer or address pointing to the local service element or database of the visited network containing the necessary connection-related information for properly handling calls to subscribers of the visited network. When, later on, the network element 1 requests to be connected to another network element of the visited network, it sends a message such as message 2 (Figure 2) to the proxy means 3. The proxy means 3 sends a message similar to message 7 to the serving means 6 of the home network. In this case, however, the message 7 only includes name or number, but no additional pointer or address, contrary to messages 5 or 7 of Figs. 1 or 2. The serving means 6 inquires the home subscriber server 13 by identifying network element 1 and requesting the transmission of the pointer or address of local service element 8 stored in server 13 in a relation to network element 1. The server 13 transmits this information as represented by arrow 14 in Figure 3, to the serving means 6. Thereupon, the serving means 6 sends message 9 to the local service element 8 as shown in Figure 2, which local service element 8 responds by returning message 10 including the connection-related information such as service class and billing rate.

In an alternative embodiment (not shown in any figure), there may be provided a redirect server in the visited network instead of the proxy means 3. Such a redirect server is described in SIP specification. In this case, a pointer pointing to the S-CSCF 6 is stored at the registration phase. When actual call is setup, the terminal 1 sends an INVITE message to the redirect server, which then replies by returning the S-CSCF address to terminal 1.

The terminal will resend the INVITE message directly to S-CSCF 6. In such a case, the charging and other call handling procedure will be correctly performed by S-CSCF 6, and it is not necessary to trust the terminal 1 to send
5 charging information.

Although the invention has been described above by mainly referring to embodiments implemented according to Release 2000 Architecture, the invention may also be incorporated in network architectures of a different type, such as GPRS-
10 based, UMTS-based, GSM-based networks, etc. Further, although the SIP Protocol is preferred, other protocols may also be used for transferring the messages such as call originating or registering messages. The scope of the invention is not limited to the above described preferred
15 embodiments and also covers modifications, amendments, omissions and alterations of the above-described features.

CLAIMS

1. Communication system comprising at least one first network element attachable to a first network and connectable to a second network element of the first
10 network, the second network element being able to access a third network element located in a second network, wherein

the first network element is adapted to send a first message to the second network element for registering to
15 the first network or getting connected to the third network element or a fourth network element of the first network,

the second network element is adapted to send a second message to the third network element, the second message containing additional information either related to the
20 handling or processing of a connection from the first network element to the fourth network element, or related to an address of, or identifier identifying, a further network element of the first network which contains, or has access to, a database comprising information related to the
25 handling or processing of a connection to the fourth network element,

the third network element being adapted to use this additional information for handling the connection or processing one or more connection-related function, or for
30 accessing the further network element, or for storing the additional information and for providing it upon request.

2. Communication system according to claim 1, wherein the message is a protocol message.

35

3. Communication system according to claim 2, wherein the protocol is the Session Initiation Protocol (SIP).

4. Communication system according to claim 2 or 3, wherein the protocol message is an INVITE or REGISTER message.

5. Communication system according to any one of the preceding claims, wherein the first network element is a user equipment of a roaming user.

6. Communication system according to any one of the preceding claims, wherein the second network element is a proxy server, preferably a proxy CSCF of the first network.

7. Communication system according to any one of the preceding claims, wherein the second network element is a redirect server in the visited network, the redirect server storing information pointing to the third network element.

8. Communication system according to claim 7, wherein the redirect server is adapted to return, when an actual call is setup and the first network element sends the first message to the redirect server, the information pointing to the third network element, the first network element being adapted to resend the first message to the third network element.

9. Communication system according to any one of the preceding claims, wherein the third network element is a control means of the second network.

10. Communication system according to claim 9, wherein the control means of the second network is a serving CSCF.

11. Communication system according to any one of claims 1 to 8, wherein the third network element is or comprises a register storing information on subscribers to the second network.

5

12. Communication system according to claim 11, wherein the register is a home location register or a home subscriber server.

10

13. Communication system according to any one of the preceding claims, wherein the first network is a network visited by a roaming user, and the second network is the home network of the user.

15

14. Communication system according to any one of the preceding claims, wherein the additional information is a charging-related information.

20

15. Communication system according to any one of the preceding claims, wherein the additional information is a service-class-related information.

25

16. Communication system according to any one of the preceding claims, wherein the additional information defines the available service capabilities of the visited network or network elements.

30

17. Communication system according to any one of the preceding claims, wherein the additional information is a time zone.

35

18. Communication system according to any one of the preceding claims, wherein the additional information is service interworking instructions of the visited network or network elements.

19. Communication system according to any one of the preceding claims, wherein the additional information is an address of or a pointer pointing to a control element of the first network which contains the additional information.

20. Communication system according to any one of the preceding claims, wherein the first and/or second network is a packet-based network, preferably an IP-based network.

21. Method to be performed in a communication system comprising at least one first network element attachable to a first network and connectable to a second network element of the first network, the second network element being able to access a third network element located in a second network, wherein

the first network element sends a first message to the second network element for registering to the first network or getting connected to the third or a fourth network element of the first network,

the second network element sends a second message to the third network element, the second message containing additional information either related to the handling or processing of a connection from the first network element to the fourth network element, or related to an address of, or identifier identifying, a further network element which contains, or has access to, a database comprising information related to the handling or processing of a connection from the first network element to the fourth network element,

the third network element using this additional information for handling the connection or processing one or more connection-related function, or for accessing the

fourth network element, or for storing the additional information and for providing it upon request.

22. Method according to claim 21, wherein the message
b is a protocol message.

23. Method according to claim 22, wherein the protocol is the Session Initiation Protocol (SIP).

10 24. Method according to claim 22 or 23, wherein the protocol message is an INVITE or REGISTER message.

25. Method according to any one of claims 21 to 24,
wherein the first network element is a user equipment of a
15 roaming user.

26. Method according to any one of claims 21 to 25,
wherein the second network element is a proxy server,
preferably a proxy CSCF of the first network.
20

27. Method according to any one of claims 21 to 25,
wherein the second network element is a redirect server.

28. Method according to any one of claims 21 to 27,
25 wherein the third network element is a control means of the second network.

29. Method according to claim 28, wherein the control means of the second network is a serving CSCF.
30

30. Method according to any one of claims 21 to 29,
wherein the third network element is or comprises a register storing information on subscribers to the second network.
35

31. Method according to claim 30, wherein the register is a home location register or a home subscriber server.

32. Method according to any one of claims 21 to 31, wherein the first network is a network visited by a roaming user, and the second network is the home network of the user.

33. Method according to any one of claims 21 to 32, wherein the additional information is a charging-related information.

34. Method according to any one of claims 21 to 33, wherein the additional information is a service-class-related information.

35. Method according to any one of claims 21 to 34, wherein the additional information defines the available service capabilities of the visited network or network elements.

36. Method according to any one of claims 21 to 35, wherein the additional information is a time zone.

37. Method according to any one of claims 21 to 36, wherein the additional information is service interworking instructions of the visited network or network elements.

38. Method according to any one of claims 21 to 37, wherein the additional information is an address of, or a pointer pointing to a control element of the first network which contains the additional information.

39. Method according to claim 38, wherein the third network element requests, after receiving the additional

information, the control element to send information on a network element to which the first network element requests to get connected, the control element responding thereto by returning such information.

40. Method according to any one of claims 21 to 39, wherein the first and/or second network is a packet-based network, preferably an IP-based network.

10 41. Network element, preferably for use in a communication system as defined in any one of claims 1 to 20, or for use in a method in accordance with any one of claims 21 to 40, the network element being able to access another network element located in another network,
15 wherein

 the network element is adapted to send, when receiving a first message from a further network element requesting registering to a network or getting connected to the another network element or an additional network element,
20 a second message to the another network element, the second message containing additional information either related to the handling or processing of a connection from the further network element to the additional network element, or related to an address of, or identifier
25 identifying, a farther network element which contains, or has access to, a database comprising information related to the handling or processing of a connection to the additional network element.

30 42. Network element according to claim 41, wherein the network element is a proxy server.

 43. Network element according to claim 41, wherein the network element is a redirect server.

35

44. Network element, preferably for use in a communication system as defined in any one of claims 1 to 20, or for use in a method in accordance with any one of claims 21 to 40, the network element serving for
5 controlling a connection between other network elements and being accessible by another network element, wherein

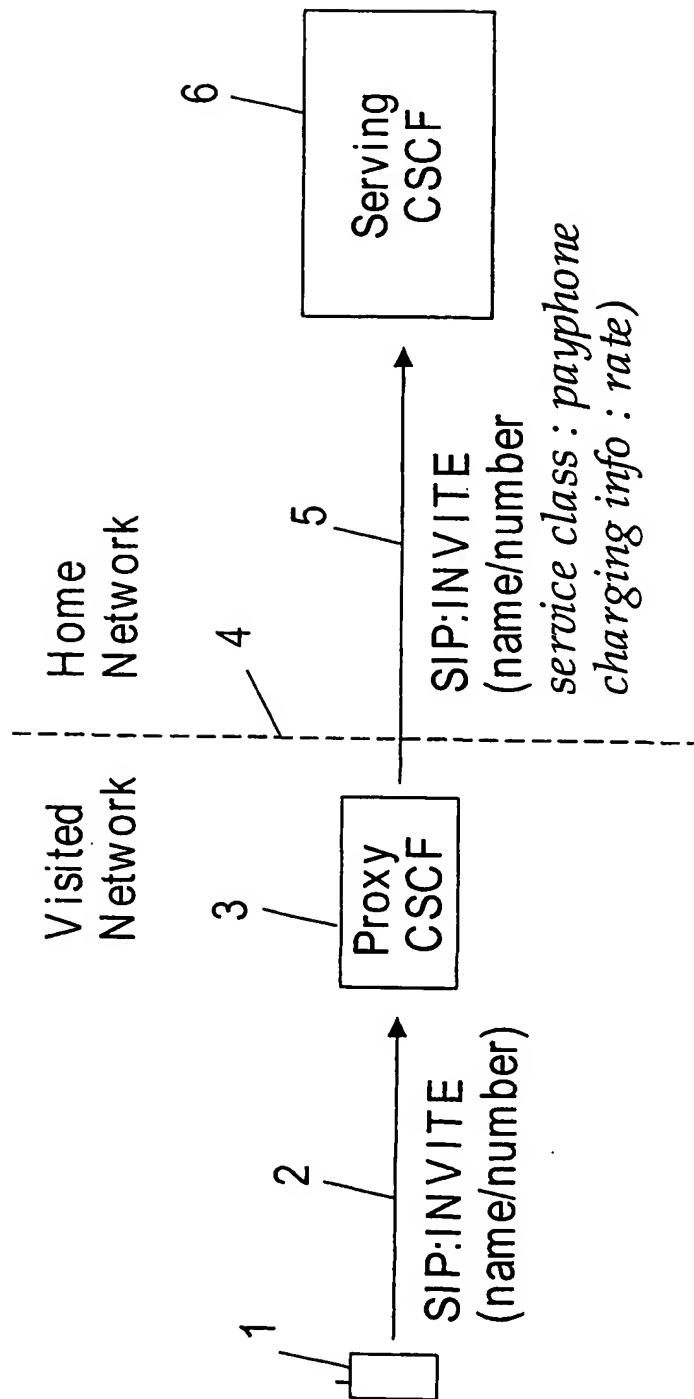
the network element is adapted to receive, from the another network element, additional information either
10 related to the handling or processing of a connection between the other network elements, or related to an address of, or identifier identifying, a further network element which contains, or has access to, a database comprising information related to the handling or
15 processing of a connection to a further network element,

the network element being adapted to use this additional information for handling the connection or processing one or more connection-related function, or for accessing a further network element, or for storing the
20 additional information and for providing it upon request.

45. Network element according to claim 44, wherein the network element is a control means of a network.

25

46. Network element according to claim 45, wherein the control means is a serving CSCF.

**Fig. 1**

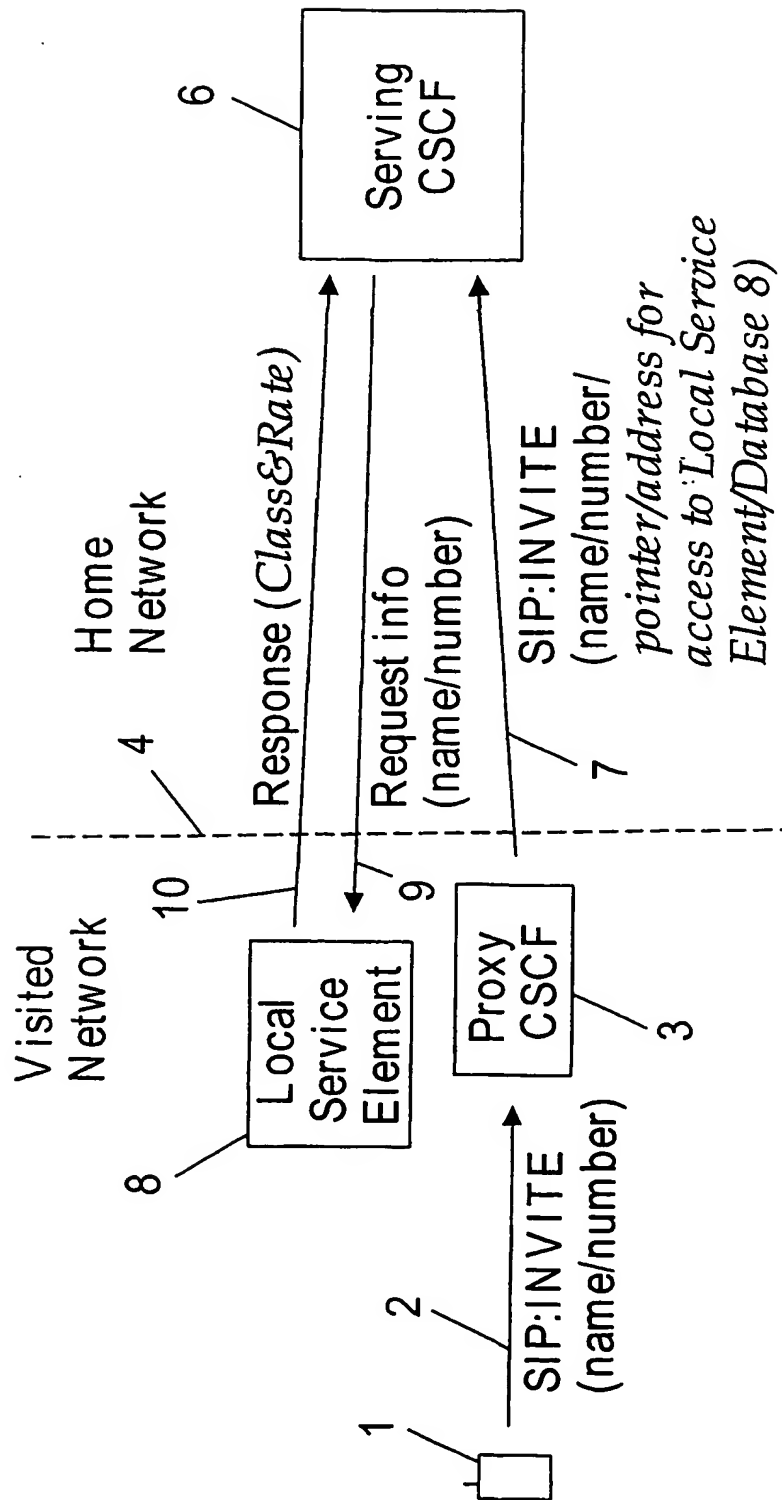
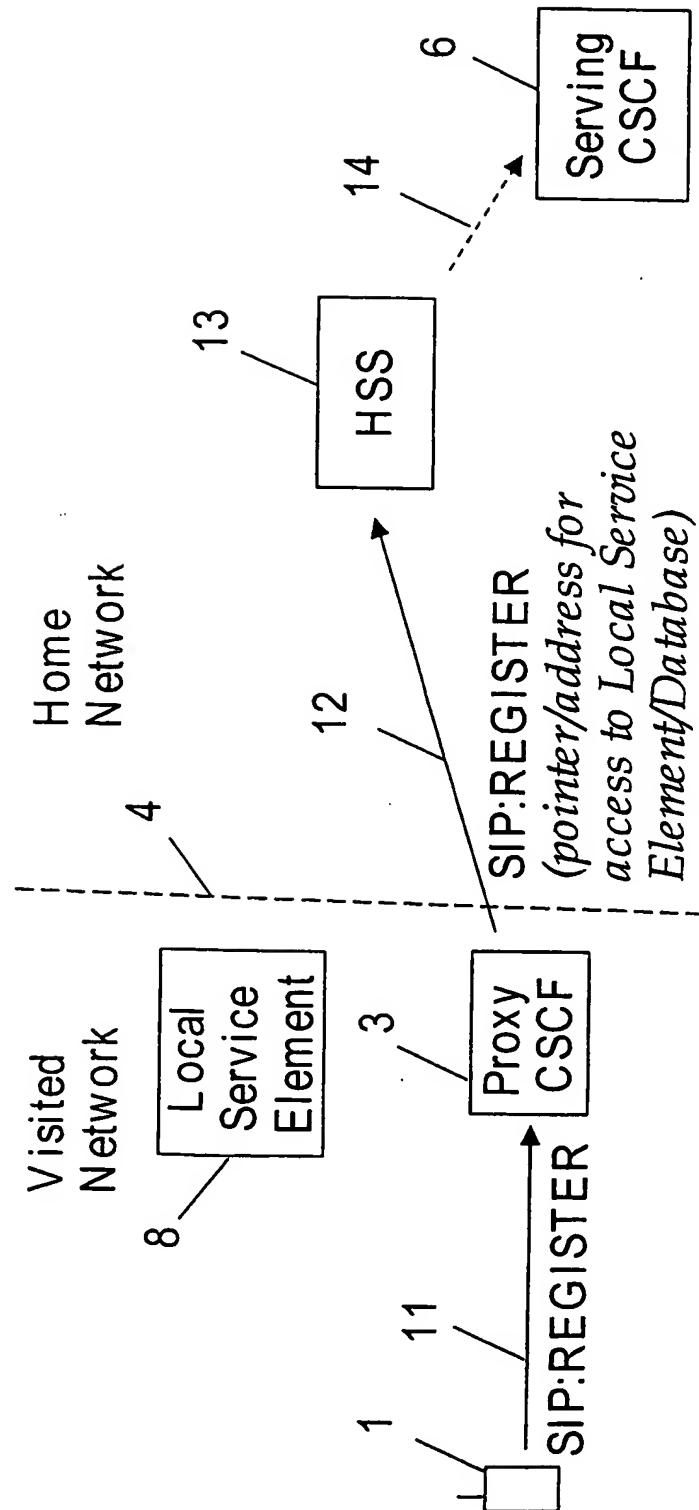


Fig. 2

**Fig. 3**

INTERNATIONAL SEARCH REPORT

Inten I Application No
PCT/EP 00/07779

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NAPOLITANO ET AL: "UMTS all-IP Mobility Management, Call and session control Procedures " INTERNET DRAFT, - 24 March 2000 (2000-03-24) pages 1-24, XP002149519 page 17, line 3 - line 28 figure 6	1-46
X	3GPP: "3G TR 23.821 V1.0.1 (Architecture Principles for Release 2000)" 3RD GENERATION PARTNERSHIP PROJECT, XP002175634 cited in the application page 29, line 16 -page 30, line 23 figure 9.1	1-46

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☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

23 August 2001

Date of mailing of the international search report

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 12104 A (ERICSSON TELEFON AB L M) 11 March 1999 (1999-03-11) the whole document	19, 38, 39
A	MOH M ET AL: "Mobile IP telephony: mobility support of SIP" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON COMPUTER COMMUNICATIONS AND NETWORKS, XX, XX, 11 October 1999 (1999-10-11), pages 554-559, XP002143545 page 555, column 1, line 2 - line 19	1-46
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INTERNATIONAL SEARCH REPORT

International Application No
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